

ZOOLOGY.—*A new entoniscid (Crustacea: Isopoda) from the Pacific coast.* LEONARD MUSCATINE, University of California, Berkeley. (Communicated by Fenner A. Chace, Jr.)

The occurrence on the American west coast of an entoniscid isopod has been recognized for some time, although the only known printed reference is that of Menzies and Miller in Light et al. (1954), p. 141. There they report that "a genus closely related to *Portunio*" is parasitic on *Hemigrapsus oregonensis* in the San Francisco Bay region. On the basis of the systematic arrangement of the 11 known genera of the family which is included in the work of Shiino (1942) on the Entoniscidae of Japan, the form mentioned by Menzies and Miller has been established as a member of the genus *Portunio* and, further, has been found to be an undescribed species. The description below follows the terminology of Shiino throughout.

This problem was suggested to me by Dr. Cadet Hand, of the Department of Zoology, University of California, Berkeley, and I am grateful to him for much kind advice and criticism.

Genus **Portunio** Giard and Bonnier, 1886

Female with two ventral and a pair of antero-dorsal ovarian processes. Marsupium complete; ascendant lamellae of first pair of oostegites entirely covered by second pair. First four abdominal segments have folded pleural lamellae. Male cephalon fused with, or distinct from, first thoracic segment. Abdomen bears ventromedian hooks. Sixth pereopod of epicaridium neither prehensile nor longer than others; propodus with simple process at its tip and rudimentary dactylus. (From Shiino.)

Portunio conformis, n. sp.

Female (Fig. 1A, B, E): From hood to tip of posterior medioventral ovarian process ca. 15 mm long; abdomen ca. 8 mm long in the largest specimen. Marsupium, when full of ova, yellowish; full of epicaridian larvae, brown to dark brown; ovary whitish to yellow; abdomen white. Exopodite of maxilliped broad, surface wrinkled, edges frilled and thicker than central portion; coxopodite egg-shaped, smaller than exopodite; endopodite lamellar, lying beneath

the coxopodite with medial border exposed. Cephalon a pair of spheres separate from the thorax. Two pairs of antennae inserted on the cephalon dorsal to the maxillipeds in the form of parallel ridges; the external antenna slightly smaller than the internal. Dorsal ovarian processes arise from middle of thorax and incline anteriorly; of the two ventral processes, the anterior is shorter and arises vertically from the thorax, forming a right angle with the posterior which projects backwards except in gravid females where the processes are somewhat displaced. Thorax cylindrical, bearing five pairs of oostegites (Fig. 1B); first pair inserted under maxillipeds and each divided into ascendant, transverse and recurrent lamellae (Fig. 1E); ascendant lamellae project anteriorly over the cephalon and continuous with the transverse lamellae which curve laterally; both somewhat thickened and supported by a vein at their inner margin; recurrent lamellae extend posteriorly the length of the thorax and curve around the posterior ventral ovarian process; these lamellae relatively thin and supported by a vein running down the center with numerous branches to the outer margins. The second pair of oostegites curves anteriorly over the cephalon, covering the first pair and forming the hood; members of this pair meet on median ventral line forming a conspicuous in-pocketing, but do not fuse. The three remaining pairs of oostegites inserted laterally on the thorax and closely applied to the host membrane; they overlap medially in young specimens and may overlap one another longitudinally without fusing, thereby remaining easily distinguishable; fifth pair slightly larger than third and fourth owing to an antero-posterior elongation of the distal border. In mature specimens, all oostegites meet their fellow on the opposite side, enclosing the recurrent lamellae of the first pair, and forming the brood pouch. The lateral protuberances of the thorax are irregularly-shaped bodies which occur in pairs (Fig. 1B); the larger usually spherical while the smaller is curved or peduncular. The second to fifth pereopoda mentioned by Shiino and earlier authors are difficult to discern in this species.

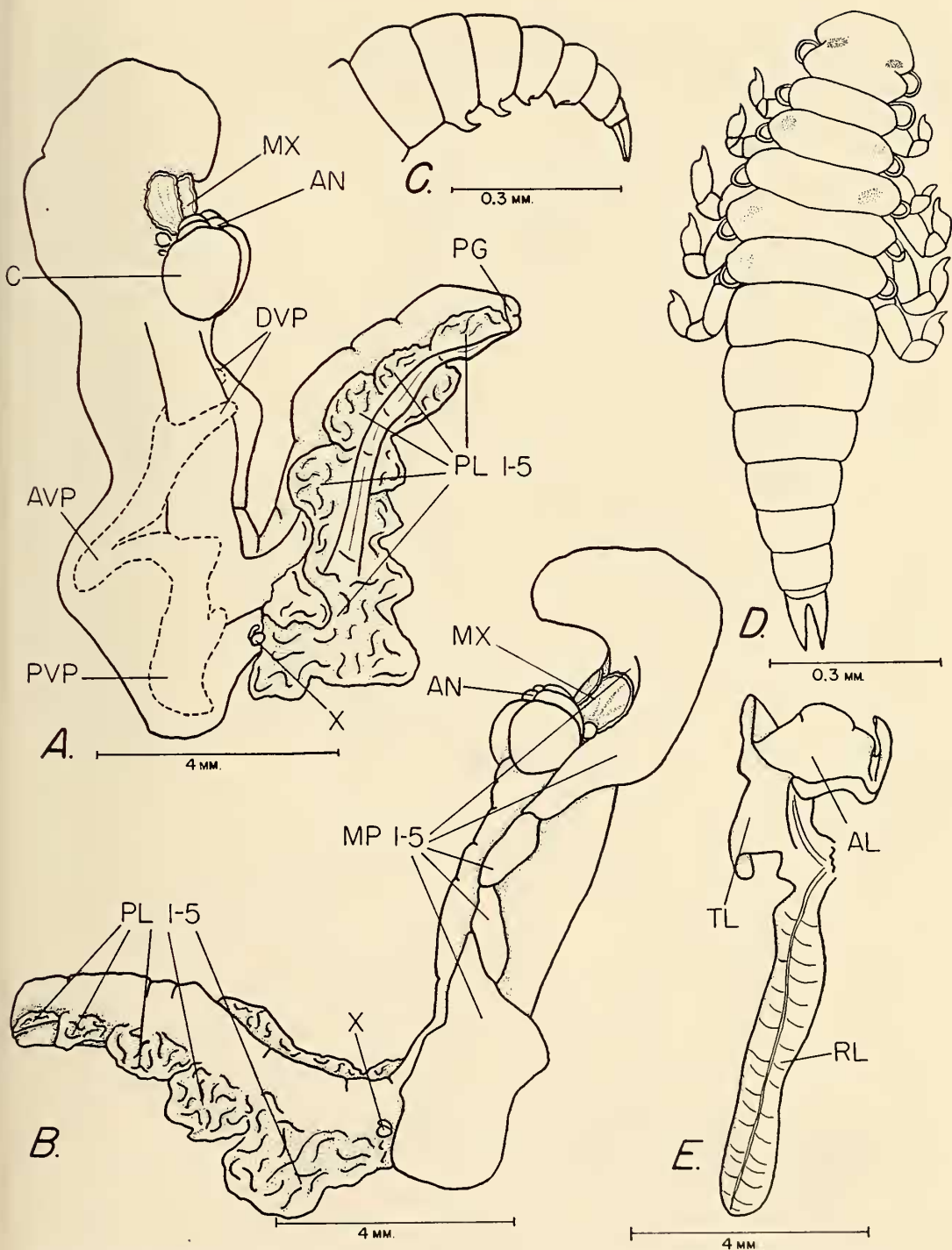


FIG. 1.—*Portunion conformis*, n. sp.: A, ♀ with thorax enclosed in host membrane; B, young ♀ with host membrane removed; C, ♂ abdomen; D, dorsal view of mature ♂; E, oostegite I. (Abbreviations: al ascendant lamella, an antenna, avp anterior medio-ventral ovarian process, c cephalon, dvp dorsal ovarian process, mp oostegite, mx maxilliped, pg pygidium, pl pleural lamella, pvp posterior medio-ventral ovarian process, rl recurrent lamella, tl transverse lamella, x lateral protuberance of thorax.)

They seem to be represented by thickenings of the anterior border of the last three oöstegites and the peduncular member of the lateral protuberance of the thorax; of these the latter is most conspicuous and corresponds to the

seventh peraeopod described by Shiino in *P. flavidus*. The abdomen bears five pairs of pleural lamellae (Fig. 1A, B); the first pair much larger than the remaining pairs and with a highly crispate margin; the rest become pro-

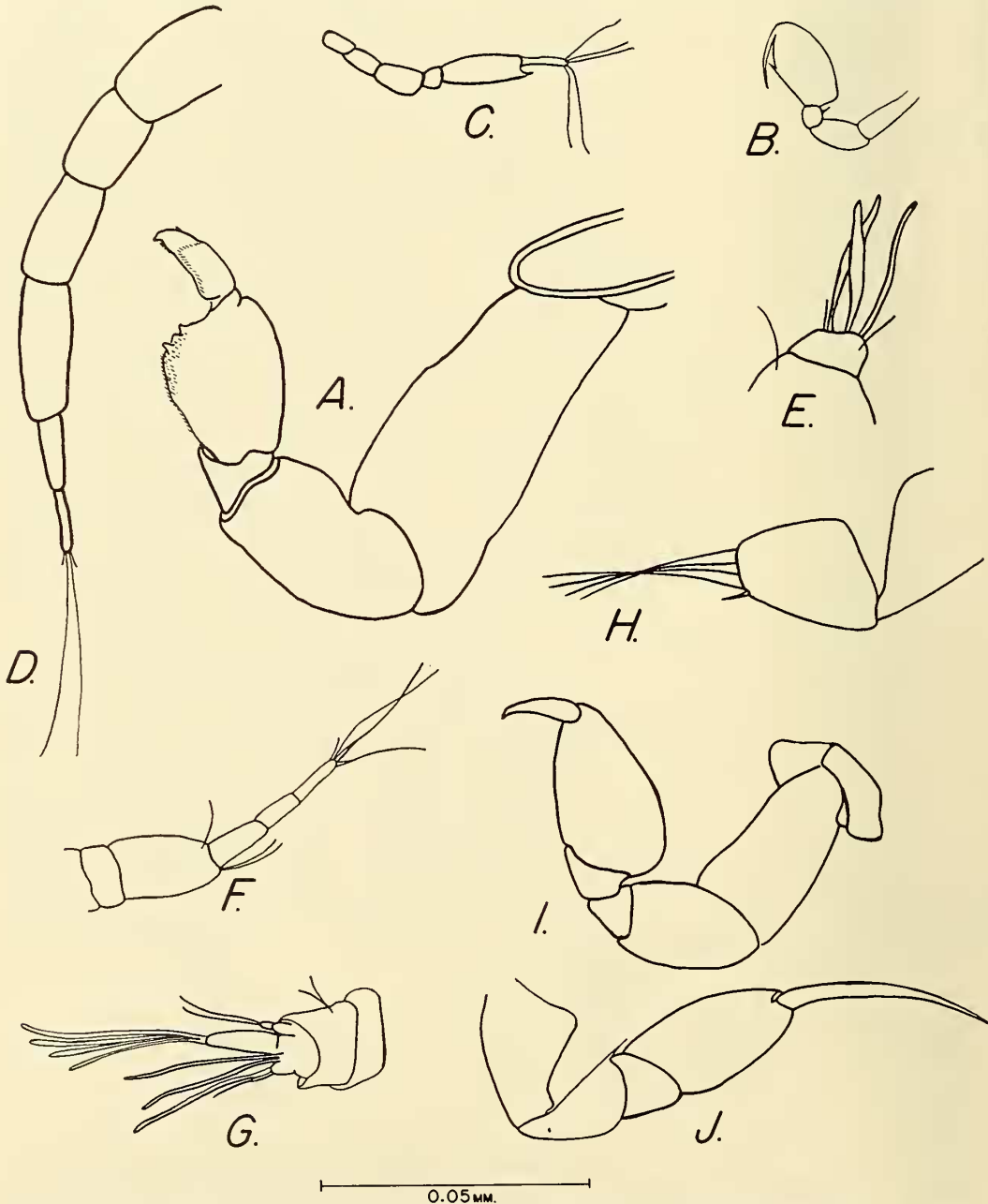


FIG. 2.—*Portunium conformis*, n. sp.: A, ♂ peraeopod IV; B-E, epicaridium (B, peraeopod I; C, peraeopod VI; D, antenna; E, antennule); F-J, cryptoniscium (F, antenna; G, antennule; H, pleopod; I, peraeopod I; J, peraeopod VII).

gressively smaller from front to back and the complexity of the marginal folds lessens; the fifth is a simple triangular lamella. The pleopoda uniramous and overlap their members on opposite sides. The pygidium small, bifurcated and curved slightly ventrally. The third abdominal segment often bulges on its dorsal surface, indicating the position of the heart.

Male (Fig. 1C, D): 1.1 mm long and at fourth thoracic segment 0.3 mm wide with scattered brown to dark brown pigment patches. Cephalon fused with first thoracic segment but distinguishable ventrally and laterally. Antennules rounded bosses bearing many small setae. Antennae absent. Oral cone bears styliform mandibles. Lateral parts of thoracic segments slightly attenuated except last segment which has a truncate margin. Coxal plates well developed and projecting laterally. Peraeopoda 5-jointed; carpopododus and dactylus clad with rows of spinules; distal margin of carpopododus bears blunt processes (Fig. 2A). Ventral spines on first three abdominal segments hooklike with pointed tip (Fig. 1C); that of fourth reduced; other segments lacking spines. Bifid ends of last segment straight, inclined ventrally at tips and more or less smooth (Fig. 1C, D).

Epicaridium (Fig. 2B-E): 0.26 mm long and 0.11 mm wide. First five peraeopoda 6-jointed with propodus bearing a short process at lateral end of distal margin and merus with small seta on its external margin (Fig. 2B). Sixth peraeopoda with dactylus straight and surmounted by a crown of long setae; propodus ends in a short pointed process (Fig. 2C).

Cryptoniscium (Fig. 2F-J): 0.5 mm long and 0.16 mm wide. Body wider anteriorly than posteriorly. General pigmentation brown in scattered patches; eye pigments darker than other pigments and well defined. Antenna 6-jointed, basal three parts larger than distal three; third bears three short hairs and sixth ends in a bundle of long hairs (Fig. 2F). Antennule 4-jointed; second joint with short setae on anterior margin; third narrower and bearing three bundles of short hairs, the outer two bundles arising from jointed tubercles; fourth still narrower, surmounted by two rami, each of which ends in long hairs (Fig. 2G). Peraeopoda 6-jointed (Fig. 2I); last peraeopod more slender than others, merus with long spine continuous with its distal margin (Fig. 2J). Exopodite of

pleopod bears four long setae and one short seta (Fig. 2H).

Distribution and habitat: Taken from Berkeley Yacht Harbor and Bay Farm Island on San Francisco Bay, Calif., and Drake's Lagoon, Marin County, Calif., where they are parasitic on *Hemigrapsus oregonensis*.

Type locality: Berkeley Yacht Harbor, Berkeley, Calif.

Types: The following specimens have been deposited in the United States National Museum: (1) Holotype, 1 adult female, U.S.N.M. no. 99177; (2) allotype, 1 adult male, U.S.N.M. no. 99178; (3) paratypes, 6 females, U.S.N.M. no. 99179.

Discussion: 372 crabs were examined from which 85 female entoniscids were obtained. These apparently included all stages of development. The frequency of infection is shown in the accompanying table.

	Host	Uninfected	Infected	Total	Percent infected	Locality
August 16 1955	♂	50	4	54	7.4	Berkeley Yacht Harbor
	♀	8	0	8	0	
August 23 1955	♂	61	12	73	16.4	Berkeley Yacht Harbor
	♀	3	1	4	25.0	
August 31 1955	♂	50	5	55	9.1	Berkeley Yacht Harbor
	♀	8	1	9	11.1	
September 6 1955	♂	22	6	28	21.4	Drake's Lagoon
	♀	17	2	19	10.5	
November 3 1955	♂	12	12	24	50.0	Berkeley Yacht Harbor
	♀	1	16	17	94.1	
December 8 1955	♂	41	12	53	22.6	Bay Farm Island
	♀	10	8	18	44.1	
TOTALS	♂	236	51	287	17.7	
	♀	57	28	85	32.9	
	♂ and ♀	293	79	372	21.2	

Simultaneous infection of a single host by more than one parasite occurred often. Where four were found in one host, they were all of the "asticot" stage. In cases where two parasites infected a single host, they were both mature and often gravid. Of the six male entoniscids examined, all were found on the females, either on the pleural lamellae, in the dorsal groove of the thorax, or on the abdomen in the mid-ventral line. In no cases were females accompanied by more than one male. Cryptoniscan larvae occurred frequently on females of all stages.

Unlike such cases as the infection of *Pinnotheres*

		<i>P. maenadis</i>	<i>P. kossmanni</i>	<i>P. flavidus</i>	<i>P. conformis</i>
Female	Ventral processes	Both processes directed backward	Anterior directed forwards, the posterior backward	Anterior vertical to thorax, posterior directed backward	Anterior vertical to thorax, posterior directed backward
Male	Cephalon	Distinct from thorax	Distinct from thorax	Fused with 1st thoracic segment	Fused with 1st thoracic segment
	Antenna	Present	?	Absent	Absent
	Abdominal hooks	In segments I-IV	In segments I-IV	In segments I-II	In segments I-IV
Epicaridium	Dactylus of peraeopod VI	Setose	?	Not setose	Setose

pisum by the entoniscid *Pinnotherion vermiforme* Giard and Bonnier as reported by Atkins (1933), where the thinness of the host's carapace reveals the presence of the parasite, the new species cannot be detected by external signs. The infected hosts appear perfectly normal and the presence of a parasite can only be determined by dissection.

The adult parasite is usually found on its side in the visceral cavity of the host. The body is V-shaped, head and thorax pointing anteriorly forming one arm, and the abdomen the other. The hepatic tissues of the host surround the head and abdomen of the parasite while the junction of thorax and abdomen lies under the alimentary canal.

Of the five species of *Portunion* previously described, *P. moniezii* Giard and *P. salvatoris* Kossmann are poorly defined. However, *P. conformis*, the new species, has short, straight, ventral ovarian processes which distinguishes it from *P. salvatoris*. The greatly developed first pair of oostegites of the new species distin-

guishes it from *P. moniezii*. It differs from the three remaining species as shown in the table above.

The species *P. flavidus* is commonly found infecting *Pachygrapsus crassipes* in Japan. This crab is a prominent member of the American west coast intertidal fauna and one might expect to find *P. flavidus* here. However, examination of 22 specimens of *P. crassipes* has failed to disclose any entoniscids.

LITERATURE CITED

- ATKINS, D. *Pinnotherion vermiforme* Giard and Bonnier, an entoniscid infecting *Pinnotheres pisum*. Proc. Zool. Soc. London 1933: 319-63. 1933.
- GIARD, A., and BONNIER, J. *Sur le genre Entone Kossmann*. C. R. Acad. Sci. **103**: 645-47. 1886.
- MENZIES, R. J., and MILLER, M. A., in LIGHT et al. *Intertidal invertebrates of the central California coast*: 141. University of California Press, 1954.
- SHINO, S. M. *On the parasitic isopods of the family Entoniscidae, especially those found in the vicinity of Seto*. Mem. Coll. Sci. Kyoto Imperial Univ. ser. B, **17**: 37-76. 1942.

Experiment is the interpreter of nature. Experiments never deceive. It is our judgment which sometimes deceives itself because it expects results which experiment refuses. We must consult experiment, varying the circumstances, until we have deduced general rules, for experiment alone can furnish reliable rules.—
LEONARDO DA VINCI.